

INVENTORY, CHARACTERIZATION, AND MANAGEMENT OF SOLID WASTE ON RANGES

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ABSTRACT

In response to many new challenges rising from an interest in safety and environmental issues associated with the disposition of residue from ranges, the United States Army Environmental Center (USAEC) is conducting an inventory of solid wastes generated from the use of munitions on Army troop training ranges. The Department of Army (DA) is working to promote a consistent approach to the management of residue items removed from its training ranges.

The USAEC is working with Radian International and the Mobile Army Corps of Engineers to identify and characterize solid waste and residual material generated by military personnel from the intended use (firing and training) of munitions. This effort is being implemented in a phased approach to provide DA with (1) a regulatory analysis of the status of range residues under the Resource Conservation and Recovery Act (RCRA) and an inventory of munitions items and the associated solid waste and residual material (range residue) generated during training exercises; (2) development of a corporate characterization scheme for residual material and development of characterization profiles for the inventory; and (3) development of Best Management Practices (BMPs) for the inventory, consistent with profiles developed in the characterization phase.

This paper focuses on the regulatory analysis and framework developed for this study. Determining the applicability of RCRA to range residue is germane to identifying characterization requirements and development of BMPs. This regulatory framework and completion of the study will assist generators of range residue manage those items in accordance with applicable RCRA requirements.

BACKGROUND

The United States Army Environmental Center (USAEC) is looking to clarify the regulatory framework for the management of range residues resulting from Army training range operations, compiling data to characterize those items that require a waste characterization, and evaluating best management practices (BMPs) for managing these items. This paper examines the requirements of the Resource Conservation and Recovery Act (RCRA) and presents an interpretation of the RCRA framework governing range scrap residues processed and further dispositioned from military ranges.

A regulatory framework, which provides a consistent approach to management of range residues, is crucial for determining characterization requirements and development of BMPs. An initial review of the applicability of RCRA to management of range residues (specifically metallic range residue) indicates that generators of these items can either (1) take advantage of a new RCRA exclusion for “excluded scrap metal” [40 Code of Federal Regulations (CFR) 261.4(a)(13)] from the definition of a regulatory “solid waste” or (2) use process knowledge to declare scrap metal resulting from range operations as hazardous waste and take advantage of the exemption for “scrap metal” [40 CFR 261.6(a)(3)(ii)] from the bulk of RCRA Subtitle C requirements. However, other related issues are raised, which are not directly addressed by this approach, such as:

- Are additional management procedures needed to ensure that these items will meet the definition of “excluded scrap metal” and “scrap metal”?
- Are additional management procedures needed to prevent release of hazardous constituents, which may be present on the scrap metal items, and to minimize concerns?

While the exclusion for “excluded scrap metal” and the exemption for “scrap metal” may be utilized, characterization and a regulatory framework are needed to:

- Address the unique characteristics of specific items (no “one size fits all”);
- Provide a consistent management approach for each item; and
- Provide the best benefit relative to a regulatory position for addressing concerns.

A discussion of the regulatory issues and recommended management framework to support this work are provided below.

Overview—Recycling Under RCRA

The U.S. Environmental Protection Agency (EPA) proposed the initial set of RCRA recycling rules on 4 April 1983 (48 Federal Register 14472 *et seq.*) and finalized these rules on 4 January 1985 (50 Federal Register 614 *et seq.*). These initial set of rules still remain in effect in large part, although individual rulemakings (e.g., the 1997 excluded scrap metal rule) have clarified the scope of the program to individual and industry-specific items.

In the preamble to the 1983 proposed rule, EPA very clearly asserted its RCRA Subtitle C authority over hazardous secondary materials that are destined for recycling. The agency stated that the U.S. Congress' mandate for cradle to grave control extended to hazardous secondary materials being recycled because they can pose the same risks to human health and the environment when improperly managed. Of greatest concern to the agency were (1) wastes recycled in a manner analogous to disposal (e.g., land application); (2) overaccumulation of materials before recycling and unsafe transport; and (3) the lack of a guaranteed end market. These concerns continue to be of utmost importance to the agency.

EPA added a category of recyclable material in the 1985 final rule—scrap metal—although it exempted this material from any Subtitle C controls [this exemption remains codified at 40 CFR 261.1(a)(3)(ii)]. Two aspects of this action deserve discussion. One is that only *hazardous* scrap metal is subject to the rules. EPA presented no data in the rulemaking on whether and what types of scrap metals exhibited metals' concentrations in excess of the Extraction Procedure (EP), currently Toxicity Characteristic (TC), regulatory concentrations.¹ With respect to metallic range residues, a position may be taken that such items are characteristically hazardous through process knowledge. However, to the extent that such residues are not hazardous, RCRA Subtitle C does not apply to post-recovery management of these materials.

The second significant aspect of the 1985 rulemaking as it pertains to scrap metal relates to the precise definitions that are used. "Scrap metal" is defined to include bits and pieces of metal parts that when worn or superfluous *can be recycled* [40 CFR 261.1(c)(6)]. The term "recycled" includes material that is used, reused, or *reclaimed* [40 CFR 261.1(c)(7)]. Scrap metal is not used or reused within the definition of these terms [see 40 CFR 261.1(c)(5)] but is encompassed within the definition of reclaimed at 40 CFR 261.1(c)(4): "a material is reclaimed if it is processed to recover a usable product or if it is regenerated." In the preamble to the 1985 final rule, EPA stated that the recycling use for scrap metal is for *metal recovery* in secondary

¹ EPA stated in the preamble that "Preliminary results of Agency studies indicate that most scrap metal is not hazardous, although some types exhibit EP toxicity" (50 Federal Register 649, fn. 41, 4 January 1985).

smelting operations and that it is the recovery of these resources from the scrap that constitutes *reclamation* (50 Federal Register 614, 624, 4 January 1985).

A third aspect of the 1985 rulemaking that deserves discussion was adoption of the solid waste exemption at 40 CFR 261.2(e)(1)(ii). This subsection essentially provides that materials that are used or reused as an effective substitute for a commercial product (without needing to be reclaimed) are not solid wastes and, therefore, are not subject to the RCRA Subtitle C program. This exemption is of interest to the extent that there may be post-recovery markets for metallic range residues that do not encompass melting (i.e., some direct use items such as brass casings and metal ammunition boxes). To this extent, management of these items would not be subject to RCRA jurisdiction.

The implications of this review of the history of RCRA recycling rulemaking are that (1) scrap metal that is directly used or reused is not RCRA regulated pursuant to 40 CFR 261.2(e)(1)(ii) and (2) scrap metal that is melted but contains nonmetal components or metal components that do not contribute material value to the end user may not be considered by the agency as being legitimately reclaimed for material recovery and, therefore, may not be entitled to the exclusion or exemption. The second consideration must be addressed in a range residue regulatory strategy given the potential for other constituents to be present on or in metallic range residues.

Detailed Analysis of RCRA Regulatory Issues

The range residues considered in this regulatory evaluation are those that will be generated at the firing point or on training and maneuver areas, which are subsequently recovered at the firing line or from down range. This regulatory analysis focuses on metallic residues, but the management framework (Figure 1) addresses all types of range residues for the sake of completeness.

The following sections discuss the RCRA regulatory issues related to management of range residue, as well as how the proposed regulatory framework (Figure 1) resolves these issues. The order of discussion is as follows:

- Issue 1: Are range residues a “solid waste”? (no if they are excluded “processed scrap metal”; otherwise, yes);
- Issue 2: Are range residues “scrap metal”? (yes if they are not “spent material”);
- Issue 3: Are range residues excluded “processed scrap metal”? (yes; otherwise they are “exempted scrap metal”); and
- Issue 4: What are the implications of the scrap metal exemption? (range residues are a “solid waste” but are not subject to any Subtitle C controls at this time).

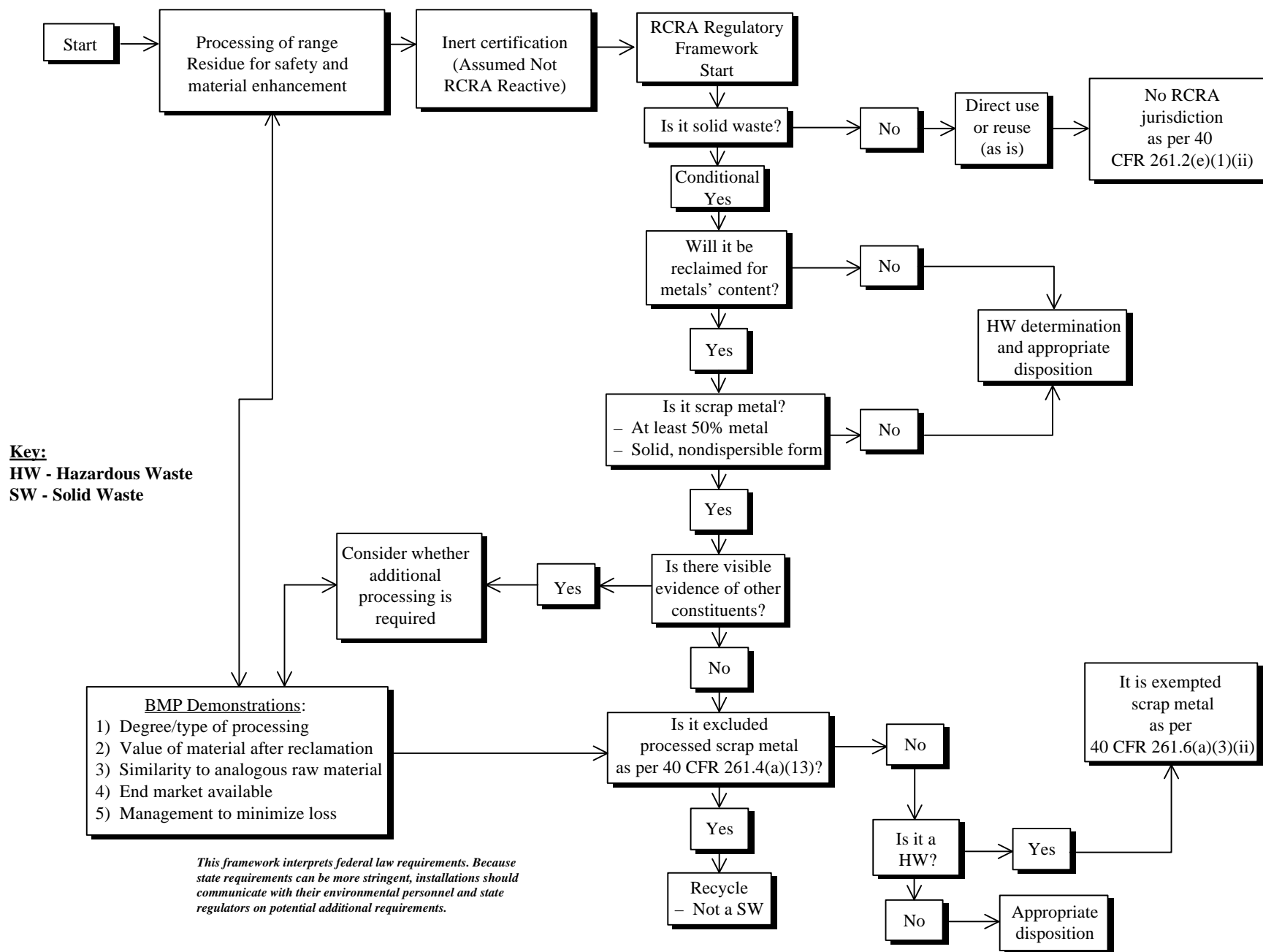


Figure 1. Federal Regulatory Framework for Range Residue Management

Issue 1: Are range residues a “solid waste”?

Summary Answer: Range residues are not a RCRA “solid waste” if they meet the definition of excluded “processed scrap metal.” Otherwise, they are RCRA “solid wastes.”

For wastes to be subject to RCRA Subtitle C controls, they must first be “solid wastes.” The statutory definition of “solid waste” includes “...other discarded material, including solid, liquid, semisolid, or contained gaseous materials resulting from industrial,... operations,...and from community activities...” This broad interpretation has left EPA much discretion in regulatorily defining the term.

On 12 May 1997, EPA amended the definition of solid waste to exclude from RCRA jurisdiction “processed scrap metal, unprocessed home scrap metal, and unprocessed prompt scrap metal.” However, EPA has not found sufficient data to justify an exclusion for “unprocessed obsolete scrap metal” at this time. Obsolete scrap metal consists of worn out metal or a metal product that has outlived its original use, such as automobile hulks, railroad cars, aluminum beverage cans, steel beams from torn down buildings, and household appliances.

Home and prompt scrap are associated with specific industries and are not, therefore, further discussed in this evaluation. The exclusion for “processed scrap metal” is obviously the most attractive for metallic range residues since it would allow management, from generation to end use, solely under generator and industry procedures and policies.

A discussion on the definition of “scrap metal” and “processed scrap metal” as they apply to range residue is provided next.

Issue 2: Are range residues “scrap metal”?

Summary Answer: As long as range residues are at least 50% metal and are in solid (nondispersible) form they are “scrap metal” and not “spent material” (spent material is potentially subject to Subtitle C controls).

An initial issue is whether range residues meet the definition of scrap metal and then processed scrap metal. EPA noted in the preamble to the final military munitions rule that the issue of the RCRA regulatory status of recycled munitions secondary material “is not unique to the military” (62 Federal Register 6633, 12 February 1997). Therefore, the issue of what EPA interprets as scrap metal can be analyzed in terms of Office of Solid Waste and Emergency Response (OSWER) interpretation of and guidance on these terms in the context of many different types of

industries. Much of this guidance distinguishes between scrap metal and spent material, which is an important distinction because spent material remains within Subtitle C regulation.

Spent material is any material that has been used and, as a result of contamination, can no longer serve the purpose for which it was produced without processing [40 CFR 261.1(c)(1)].

Contamination can include an impurity, factor, or circumstance that causes the material to be taken out of service for reprocessing [OSWER Directive 9441.1994(07)]. Historically, EPA has considered materials such as spent solvents, spent acids, spent caustics, spent batteries, and spent activated carbon as spent material [48 Federal Register 14476, 4 April 1983; OSWER Directive 9441.1994(07)]. While the agency's interpretation of the term "contamination" is arguably broad enough to include range residues, a key distinction is that it is not the original product itself that is spent in this instance. The other examples (e.g., acids, carbon) were products that have been used and can no longer be used for process cleaning or filtering and which, *in their original state*, need to be reprocessed (e.g., regeneration of spent activated carbon) to be used again (e.g., for process filtering as activated carbon). In the instant case, the material is a *residue* not in its original product state and it will not be reprocessed to produce the same product used for the same purpose (i.e., a useable munitions item).

Scrap metal is bits and pieces of metal parts, or metal pieces that may be combined together with bolts or soldering that, when worn or superfluous, can be recycled [40 CFR 261.1(c)(6)]. EPA guidance is that the material *must have a metal content of at least 50%* [OSWER Directive 9441.1990(09a)] and that it be in *solid, nondispersible form* (61 Federal Register 2362, 25 January 1996; small fines not included). Range residues appear to most closely approximate bits and pieces of metal parts that are worn (from the intended use of the original product). An EPA memo agrees that metal fragments from fired munitions can be classified as "scrap metal" rather than "spent material."² EPA has similarly held zinc bar, nickel plate, and cadmium plate (metal portions) of spent batteries [OSWER Directive 9441.1986(79)] and lead foil used in dental X-ray packages [OSWER Directive 9441.1993(05)] as scrap metal.³

² EPA, OSWER, letter from EPA Headquarters (Jeffery Hannapel) to EPA Region V (Duncan Campbell), 17 March 1997. See also 62 Federal Register at 6631, column 2, where the Munitions Rule refers to the scrap metal exemption.

³ On the other hand, chopline residues, which are generated from processing scrap wire, were considered by EPA as spent material because they primarily consist of plastic and are recovered for polyvinyl chloride, even though 5% of the residues consist of copper that can also be recovered [OSWER Directive 9441.1996(10)]. EPA deferred to individual state determinations when faced with the question of whether brass particles generated from the belting and buffering of brass castings are scrap metal [OSWER Directive 9441.1993(15)]; however, the agency may have deferred on this point because the particles may be similar to fines, which have not traditionally been considered nondispersible under the scrap metal interpretations. Note that the definition of "processed scrap metal" adopted 12 May 1997 does include fines and drosses, but only if they have been agglomerated.

Based on the foregoing, *it would appear that range items, which are solid, metallic, and in nondispersible form, are more like scrap metal than spent materials.*

Issue 3: Are range residues excluded “processed scrap metal”?

Summary Answer: Yes, range residues meet the definition of excluded “processed scrap metal,” although documentation of “processing” activities must be conducted. Otherwise, range residue meets the definition of “exempted scrap metal.”

In January 1996, EPA proposed to amend the definition of solid waste to exclude processed scrap metal being recycled from RCRA jurisdiction. This rule was finalized at 40 CFR 261.4(a)(13) on 12 May 1997. According to EPA, “processed scrap metal being recycled is distinct from other secondary materials defined as wastes when recycled due to established markets for the material’s utilization, inherent positive economic value of the material, the physical form of the material, and absence of damage incidents attributable to the material, and is therefore sufficiently product-like that maintaining RCRA regulatory jurisdiction over this material is not necessary” (62 Federal Register 26011, 12 May 1997).

“Processed scrap metal” is defined at 40 CFR 261.1(c)(10) as “...scrap metal which has been *manually or physically altered to either separate it into distinct materials to enhance economic value or to improve the handling of materials*” (emphasis added). The category of processed scrap metal includes scrap metal that has been “baled, shredded, sheared, chopped, crushed, flattened, cut, melted, or *separated by metal type (i.e., sorted), ...*” *regardless of who does the processing* (generator, an intermediate handler, or the ultimate recycler).⁴ *Range scrap metal items that are processed in the manner cited above meet the definition of “excluded processed scrap metal.”*

EPA cited five decision factors in the proposed rule (61 Federal Register 2362 *et seq.*, 25 January 1996) that led it to conclude that processed scrap metal should be allowed to exit the RCRA program. The Department of Defense should be able to demonstrate that management practices and business incentives for recycling of metallic range items are similarly present with respect to each of the factors outlined below. These factors must be given consideration during the remainder of this study and development of BMPs.

The first factor is *the degree of processing the material has undergone and the degree of further processing that is required*. The agency is interested in the extent to which the scrap metal has been *separated, melted, or otherwise processed* to add value or *improve handling qualities*. An

⁴ 62 Federal Register at 26018.

example is removing nonmetallic components (e.g., fluff and plastics) that may be dispersible (easily separated from the metal and, thus, had the potential to be lost to the environment) and that do not contribute value for metals' recovery.

The second factor is *the value of the material after it has been reclaimed*. According to EPA, processed scrap metal is typically traded nationally and internationally in established markets for positive economic value (i.e., the processor is paid by the purchaser for the metal) and there are market specifications for purity and physical form. There should be no issue regarding the fact that metallic range residue, as "scrap metal," has established recycling markets. In addition, there are material specifications for scrap metal adopted by the Institute of Scrap Recycling Industries, Inc. (ISRI) (Scrap Specifications Circular 1998, consisting of Guidelines for Nonferrous Scrap: NF-98 and Guidelines for Ferrous Scrap: FS-98) applicable to generators and intermediate handlers.

The third factor is *the degree to which the reclaimed material is like an analogous raw material*. According to EPA, processed scrap metal is analogous in composition to raw metal concentrates and intermediates. Electric arc furnaces use processed scrap iron and steel as input, while the integrated steel industry (a competitor) uses basic oxygen furnaces that input iron derived from iron ore. This factor is further discussed below with respect to the presence of other constituents on some range scrap metal.

The fourth factor is *the extent to which an end market for the reclaimed material is guaranteed*. EPA wants to be sure that processed scrap metal that is recycled is a viable substitute for raw material feedstock that is finite and nonrenewable, such as ores. This factor is similar to factor three in that, ultimately, the end users are the test: do they or will they, in fact, accept range residues directly or through intermediaries for processing for metals' recovery?

The fifth factor is *the extent to which a material is managed to minimize loss*. EPA notes that solid, nondispersible scrap metal (1) has little potential for release and (2) is typically managed to prevent loss because it has economic value. The primary environmental incidents associated with metal recycling relate to the handling of distinct components, such as battery removal, breaking, and disposal facilities. For this reason, EPA excluded such components from the definition of "scrap metal."

Issue 4: What does the scrap metal exemption mean?

Summary Answer: While the processed scrap metal exclusion allows range residue to completely exit RCRA, the scrap metal exemption regulates the residue as a "solid waste" which,

if hazardous, is subject to the Subtitle C program. However, at this time, recycled scrap metal is exempted from Subtitle C requirements.

If metallic range residue cannot meet the excluded processed scrap metal definition, it is a “solid waste.” However, at this time, 40 CFR 261.6(a)(3)(ii) provides that none of the RCRA requirements of 40 CFR Parts 262 through 266 or Parts 268, 270, or 124 apply to generators or processors of exempt scrap metal. Therefore, there are no technical, recordkeeping, or reporting requirements under federal RCRA law.

Outline of Recommended BMPs within the Regulatory Framework

Based on the regulatory analysis and framework presented in this paper, the five evaluation factors that led to EPA’s exclusion of processed scrap metal must be given consideration during the remainder of this study and development of BMPs.

Some initial approaches and considerations for developing BMPs to ensure that range scrap metal is managed within the regulatory framework are outlined below.

- **Processing Activities.** Factor 1 of EPA’s decision criteria for the processed scrap metal exclusion (the need to show that metallic range residue has been subjected to manual or physical processing to add value or improve handling qualities) is the most critical to address in the BMPs. “Processing” metallic range residue is inherent to training, managing items that pose explosives’ safety hazards, and recovering and recycling items with material value. Many of these practices involve visual inspection, sorting, and separation; however, some physical practices for demilitarization purposes (e.g., deforming) are also conducted. Although these activities are conducted primarily for non-environmental reasons as a part of current procedures and practices, they add value to the range scrap metal and improve material handling qualities. These practices can be documented and institutionalized in BMPs to support the claim to the RCRA “processed scrap metal” exclusion. A key component of this institutionalization is to ensure that these procedures are standardized, as applicable, and consistently followed within and between the services, as applicable.

Some categories of range residues show visible evidence of other constituents even after the inert certification process (less than 10% explosive/reactive material). For these items, the BMPs will be considered to establish an additional screening stage (beyond the initial field sorting/separation and inert certification/demilitarization processes) that would allow a field decision to be made relatively easily as to whether additional “processing” needs to be done for environmental reasons (factor 3 of EPA’s decision criteria) or whether the item should be managed as a waste due to the infallibility and/or impracticability of additional processing.

The ISRI qualitative guidelines may be used in the BMPs to establish (1) some type of field visual screening criteria for the items of concern and (2) as needed based on the criteria, a field decision made as to whether additional processing for *environmental reasons* is warranted, cost effective, and feasible.

- **On-Site Storage and Management.** On-site management practices need to reflect the economic value of the residues, including potential time limits on accumulation periods (factor 5 of EPA’s decision criteria for excluded processed scrap metal). From an environmental standpoint, it is beneficial to show that residue storage and handling areas are encompassed within the storm water runoff protection programs that include monitoring of runoff for constituents of concern. In some locations, and depending on the nature and volumes of the residues, it may be prudent to establish pads and/or rain protection covers for on-site management. The handling of range residues in containers (drums, rolloffs) that are covered (lid, tarp) when not in use may also be considered.
- **Demonstrated Knowledge of Intermediate and End Markets.** EPA’s RCRA exclusion of processed scrap metal was based, in large part, on its economic value (factors 2 and 4). There are identifiable and guaranteed markets for scrap metal, as well as material specifications. No BMP needs to be developed to address these decision factors. However, a stronger tracking mechanism could be established to ensure that metallic range residue recycling programs remain apprised and aware of any scrap metal recycling industry changes in material specifications or recycling practices that would affect the ability to supply scrap metal to the market.

Summary of Regulatory Analysis and Framework

Determining the regulatory status of materials that are destined for recycling is one of the most complex and confusing aspects of the RCRA program. Unless an exception or exclusion applies, EPA considers its Subtitle C jurisdiction to extend to hazardous secondary materials that are recycled. *In EPA’s view, the key question is what hazardous secondary materials are deserving of RCRA Subtitle C cradle to grave controls? The answer is based on both what the material is and how it is actually managed.* Even for a particular material that will be recycled (such as a metallic ammunition box), there is no “one size fits all” answer since the RCRA status of a particular item can vary depending on the method of recycling (the box reused as is for ammunition storage escapes RCRA jurisdiction as a direct use item, while the same military item that is demilitarized to be sold for melting is excluded “processed scrap metal”).

The most favorable position is *the scrap metal exclusion*. The exclusion is an approach that can be advanced by producers of range residues when these residues are destined for recycling.

Recycled metals are excluded from the definition of “solid waste” as “excluded processed scrap metal” and, therefore, cannot be hazardous waste subject to Subtitle C controls. This paper presented five decision factors that led EPA to finalize the exclusion; the most significant of which is that “processing” of the scrap metal occur.

It is beneficial to document and institutionalize all the processing activities required for inert certification, demilitarization, and recycling purposes (i.e., for “non-environmental” purposes), since these activities directly support the RCRA regulatory exclusion for “processed scrap metal.” These practices include, but are not limited to, the following examples:

- Sorting and segregation on range of metallic range residues (conducted by training units or range clearance personnel) by metal type, caliber, or other reasons;
- Sorting and segregation of field-returned items at Ammunition Supply Points;
- Demilitarizing/deforming metallic range residues, removing non-metallic components from items, and mechanically separating components of different metal type; and
- Demilitarization and inert certification procedures implemented for safety reasons and for material handling reasons (i.e., to obliterate any unique military features) and the ammunitions, explosives, and dangerous articles residue disposal process implemented for safety reasons.

Another regulatory approach is the RCRA *recycled scrap metal exemption*. This exemption is less favorable than the exclusion referred to above because it provides that scrap metal is a “solid waste” (so RCRA jurisdiction applies). However, at this time, recycled scrap metal is exempted from RCRA’s Subtitle C requirements.

BMPs can validate scrap range residue recycling. In addition to providing needed guidance to field personnel, these BMPs are sound risk management approaches to:

- Document and standardize the “processing” undertaken on range residues to qualify for the RCRA scrap metal exclusion and
- Address potential “gray” areas in the recycling rules, such as the presence of other constituents on some items or categories of range residues, by providing a management process that minimizes the potential for harm to human health and the environment.